

Behavioral ecology of sika deer in spring in semi-natural area

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Abstract: Behaviors of sika deer in spring were studied by scan sampling, ad libitum sampling, and all-occurrence recording methods during 1998. The results showed that behaviors of sika deer in spring can be classified by seven categories: grazing, ruminating, bedding, moving, standing, drinking, alert, agonistic and other behaviors. Various behavioral models were more regular. Grazing behavior was a kind of mainly behavioral model.

Key words: semi-natural; sika deer; behavior; ecology

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Introduction

Sika deer is listed in the first grade important protected animals of "Wildlife Protection Law in P. R. China", wild sika deer is rare in forestry areas. The systematic research for ecological characteristics of wildlife is a presupposition and base of scientific management. The domestic and overseas experts and researchers have carried out some studies for sika deer, mainly centering on number, distribution, feeding, breeding, development, natural enemy, food habit, disease and so on.

Behavioral studies of Cervidae were reported by some researcher. (Cai *et al.*, 1988; Song 1990, 1993; Yu 1990; Zhang *et al.*, 1990; Zhang *et al.*, 1992; Jia 1996; Du *et al.*, 1998; He *et al.*, 2000, 2001; Wang *et al.*, 2000; Zhang 2000). The social behavior (Guo 1991) and activity rhythm (Liu *et al.*, 1999) of sika deer was studied too. The systematic studies on individual behaviors haven't been reported. From May to June 1998, behaviors of sika deer were studied in Pingshan Wildlife Experimental Farm of Heilongjing Forestry Academy of Science.

Study Area

The research was conducted in Pingshan Wildlife Experimental Farm (127°19'-127°24'E, 45°13'-45°19'N). The

area of Experimental Farm is 463 hm², including three feed sites of Zhongxin, Wujianfang and Lijiaweizi. There were 460 sika deer in semi-natural area, with a population density of 0.99 individual/hm².

This area is located in the northwest of Zhangguangcai Mountains. The climate of this area is twofold influenced by the ocean circulation and continental cold wave, so the seasonal change of climate is clear. Summer is mild and rainy, and winter is cold and dry. Annual average temperature is 3.5 °C. Annual average precipitation is 500-650 mm. Annual evaporation is 500-600 mm. The vegetation of this area belongs to cold temperature zone theropencedrymion, mainly concluding *Quercus mongolica*, *Fraxinus mandshurica*, *Tilia amurensis*, *Corylus heterophylla* and so on.

Method

In study area, sika deer is fed in semi-natural pattern. As spring is antler-developing period of male, gestation period of female, most of adult males have been confined in shed. Only few adult males are free, moreover, all subadults and females are also free, and the number is 238. Sika deer mainly moves around Zhongxin feed site.

Although sika deer moves in big group about 100 individuals in spring, we can distinguish small groups from big groups. Basically, there are monogynopaedium group and adult female group, accidentally individual female and individual male. Such ecological characteristic of sika deer makes easy for us to observe. As sika deer is very alert by nature, we did observation only by 8×30 telescope with a distance of 50-150 m. Behavior of individual sika deer was observed from 7:00-17:00 hour even day. We carried out

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an observation from 3:00-21:00 every other 5 days.

During the preliminary observation, we obtained most of the behavioral patterns by Ad libitum sampling method. During the whole observation, grazing, moving, standing, alert, protecting velvet and social behaviors were recorded for every 5 minutes using scan sampling method. The frequency and duration of every behavior were recorded by all-occurrence recording method.

We recorded the sex of sika deer by antler. If the velvets of some male were out, we can determine from antler stub. Male was divided into young (1-year-old) and adult (fork-horn) based on the shape of male antler. Female was divided into young and adult by body size.

Results and Discussions

Intensity of behavioral expression

In spring, there are significant differences among expression intensity of various behaviors. Among five major behaviors, expression intensity of grazing behavior is most significant (49.14%), followed by is ruminating (21.22%) and bedding (18.86%) behaviors, standing (6.34%) and moving (4.44%) (Fig.1).

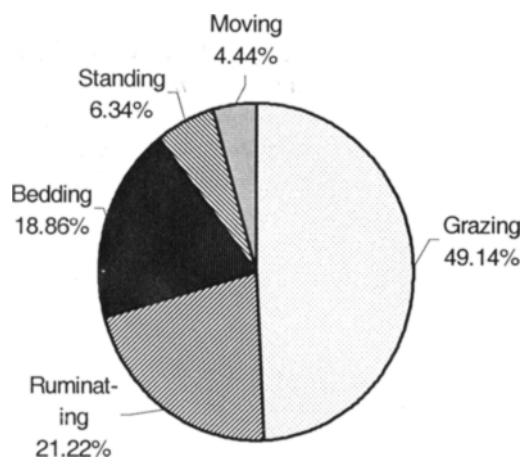


Fig. 1 Time budget of five behaviors by sika deer

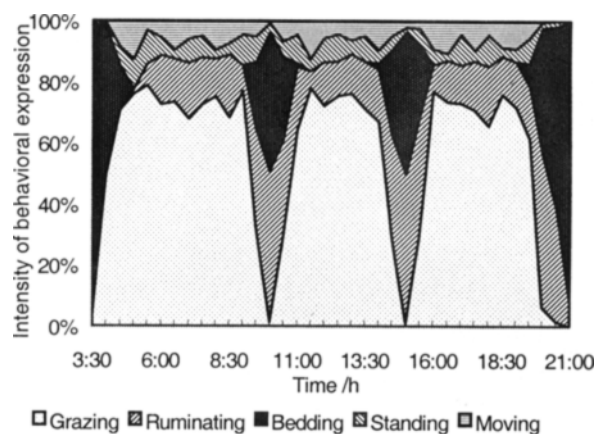
From behavioral regulation of sika deer, we learnt that there are three grazing peaks in a day, 4:00-9:00, 10:30-13:00, 15:30-19:00, and two bedding peaks, 9:00-10:30, 13:30-15:30. Ruminating behavior has two peaks: 8:30-11:00, 13:30-15:30, which have overlaps with bedding behavior. There is little variation between moving and standing behaviors (Fig2).

The results shown in Fig.2 is different from that of red deer (Chen *et al.*, 1997). Because the period that the sika deer was foddered everyday was at 8:30-9:30 and 15:30-17:00 in Zhongxin of Pingshan Wildlife Experimental Farm, in this case the sika deer had formed the conditional reflex, and gradually changed its active regulation.

Grazing behavior

Grazing behavior of sika deer has three high peaks: in the morning, at noon and in the evening. Of all behaviors, grazing takes up most of the time in the whole activity time.

The main food of free sika deer should be browses and young leaf of shrub, the fresh grass is only a part of whole food, whereas the vegetation of Pingshan Wildlife Experimental Farm has been destroyed heavily, and the shrub layer nearly vanished. During observation, sika deer mainly grazed fresh grass, meanwhile it also eats little browse, tender leaf and twigs. Sika deer grazes in big group pattern. Though the distance among small groups is short, we can distinguish small groups from big groups. During the whole day, sika deer needs the alter 7-23 grazing areas in which



settling time varied from 20 min to 2 h.

Fig. 2 Activity change of five main behaviors of sika deer

Ruminating behavior

Ruminating behavior of sika deer accounts for 1/3 of the whole active time, and which is similar to red deer (Chen *et al.*, 1997). Due to sika deer grazes quickly, and chews slightly, then swallows instantly, so the alimentary bolus need to be retrogressed into mouth and chewed again. Generally 40-60 min after browsing, the groups of sika deer begin to bedding, licking their mouth by tongue, and then begin to ruminate. Rumination course is composed of four stages: retrogression, chewing again, combining with saliva and swallowing again. The time and frequency is determined by food variety, availability, environment and other factors. In spring, sika deer ruminates for 10-20 times everyday, 20-30 min/time. Sika deer often ruminates during bedding, sometimes during standing.

Bedding behavior

Bedding behavior of sika deer includes resting and sleeping behaviors, and appears in three periods: 19:00-4:30, 9:00-11:00, 13:00-15:00. While bedding behavior rarely happens during other periods, one among sika deer is responsible for warning all the time. Sika deer often selected bedding site under the foot of hill or on flat

hillside. In the daytime, the selection of bedding site is often random, while at night, sika deer often choose flat hillside near artificial feeding area. After grazing or moving for a long period, sika deer needs to rest.

Moving behavior

Moving behavior of sika deer is composed of walking, running slowly, running and chasing between two individuals in spring. Sika deer groups need to alter 7-23 grazing areas everyday. Moving mode is chiefly walking, while running slowly, running and chasing between two individuals are occasioned. Moving route is regular, and the deer path is often seen due to frequent walking. When sika deer walks, its head is higher than dorsal line, and fore and posterior limbs act cooperatively. Chasing among individuals is seen in playing and agonistic behaviors.

Standing behavior

Standing behavior of sika deer happens infrequently. After grazing for a long period, sika deer stands and observes circumstances. In respect to standing posture of sika deer, its four limbs are similar to those of grazing behavior during final period, only head is higher than dorsal line. In addition to grazing later, the standing behavior also happens after moving and bedding behavior.

Drinking behavior

In spring, there is almost no natural water source in the study area and only few cisterns in Zhongxin area. From 6:00 to 7:30 and 17:00 to 18:30 hours, sika deer often returns to Zhongxin for drinking. But the groups do not return to Zhongxin for drinking at this time everyday. Sometimes sika deer do not return to drinking for 4 days in succession, grazing fresh grass. Generally, the mouth of sika deer is inserted into water to drink, and the nares expose. Sika deer drinks water into mouth by open and close of upper lip and lower jaw. After drinking, it licks its mouth and nose by tongue.

Alert behavior

Sika deer is alert by nature. With the aid of auditory and smell, it can find abnormal phenomena and show alert behavior. Sika deer pricks up ear, which sways forward and backward or crosses front and behind, and hears or sees towards the direction of sound and foreign body, and distinguishes from sound and direction as well as distance of foreign body. If sika deer feel dangerous they will flee. After a period of time, they will stop to turn round or look around. Once they were dangerous indeed, they will flee quickly. At the same time, sika deer lifts head and neck, and trots or jumps. If there are no dangerous, sika deer will stop run, walks towards one place, even sometimes walks round, and continues to graze.

Agonistic behavior

Agonistic behavior consists of aggressive and wrestling

behaviors. Aggressive behavior mainly shows posture and signal, other than direct contact of body. General aggressive behavior is the head moving briefly, meanwhile ears moving backward, or head and neck stretching out forward, two ears towering backward. When sika deer attack, they stand in site, or walks quickly towards aggressed individuals, and kicks the opposite side by fore hoof. Sometimes, aggressed sika deer was touched down by aggressor so as to express submission. Neighing and biting among sika deer is a kind of aggressive behavior, which is fiercer than symbolic treading and kicking. The aggressed parts are usually back or muscle of posterior legs. Sika deer often expresses aggression by head and neck stretching out and ears backward.

In spring, there are many wrestling behaviors, which happen among young male sika deer. This is usually playing behavior for missing antler. Wrestling among females is usually lifting fore limbs, then falling forward, treading and kicking or fighting. Meanwhile, sika deer demonstrate towards the opposite side by slanting body forward. Wrestling behavior happens infrequently among adult males, because this period is developing velvet.

Protecting velvet behavior

Spring is the period that sika deer develops velvet, so their activity is very careful. It is very difficult to see contradiction each other. When grazing, sika deer often keeps distance from its velvet and trunk or thick branch. When moving in the forest, sika deer lift its head, and make velvet forward and backward so as not to be scraped by rattan or shrub branch. Moreover sika deer often chooses sparse wood, few shrub areas as migrating route.

Other behaviors

Other behaviors of sika deer include grooming, playing, crying, shitting and so on. Grooming behavior of sika deer gives priority to scratching and trembling. In rainy day, trembling all over the body is frequent, which is related to having rain drops all over the body. Before and after bedding, sika deer prefers rolling. Rubbing tree is occasioned. Playing behavior is only seen among subadults, between mother and young. Crying accompanies alert behavior, when sika deer finds itself in danger, it often alarms towards other sika deers by crying, and steps on the earth with fore feet. When individual young falls behind, it also keeps in touch with others by crying. In early morning shitting is frequent, however other periods in a day shitting behavior is random.

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